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(54) **ORGANIC LIGHT-EMITTING DEVICE HAVING LIGHT-EMITTING PATTERN AND METHOD FOR PREPARING THE SAME**

ORGANISCHES LEUCHTBAUELEMENT MIT LICHTEMITTIERENDEM MUSTER UND VERFAHREN ZU IHRER HERSTELLUNG

DISPOSITIF ÉLECTROLUMINESCENT ORGANIQUE PRÉSENTANT UN MOTIF ÉLECTROLUMINESCENT ET PROCÉDÉ DE PRÉPARATION DUDIT DISPOSITIF

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Description

Technical Field

[0001] The present invention relates to an organic light emitting device, and a method for producing the same. More particularly, the present invention pertains to an organic light emitting device having a light emitting pattern, and a method for producing the same.

Background Art

[0002] An organic light emitting device includes two electrodes and an organic material layer that is interposed between the electrodes, and electrons and holes are injected from two electrodes to the organic material layer, so that a current is converted into visible rays to emit light.

[0003] FIG. 1 is a sectional view of a conventional organic light emitting device. With reference to the drawing, the organic light emitting device includes a light emitting layer 50 that is interposed between two electrodes, for example, an anode electrode 20 and a cathode electrode 70. Any one of the two electrodes, for example, the anode electrode 20, is provided on a transparent substrate 10, and light that is emitted from the light emitting layer 50 passes therethrough. The organic light emitting device may further comprise one or more layers that are selected from the group consisting of an electron injecting layer 65, an electron transporting layer 60, a hole transporting layer 45, and a hole injecting layer 40 in order to improve performance.

[0004] The organic light emitting device may further include an insulating layer 30 having a predetermined pattern on an electrode on the transparent substrate 10 to separate a light emitting region A) and a non-light emitting region B).

[0005] US2004/077250 A1 discloses an organic light emitting device comprising an organic multilayer stack which can be patterned by direct exposure to ultraviolet light.

Disclosure of Invention

Technical Problem

[0006] It is an object of the present invention to provide a method of easily producing an organic light emitting device having a light emitting pattern by comprising changing a portion or all of functions of predetermined pattern regions of one or more layers of an organic material layer, and an organic light emitting device that is produced by using the method.

[0007] It is another object of the present invention to provide a method of easily producing an organic light emitting device having a light emitting pattern by changing a portion or all of functions of predetermined pattern regions of one or more layers of an organic material layer using DLP (digital light processing), and an organic light emitting device that is produced by using the method.

Technical Solution

[0008] In order to accomplish the above-mentioned objects, the present invention provides a method of producing an organic light emitting device according to the independent method claim 1.

[0009] According to an embodiment of the present invention, the changing of the functions of the predetermined pattern regions of one or more layers of the organic material layers may be performed by using DLP (digital light processing).

[0010] Furthermore, the present invention provides an organic light emitting device according to the independent apparatus claim 9.

Advantageous Effects

[0011] An organic light emitting device includes a layer that has a partially or wholly changed function in a region corresponding to a predetermined pattern. Thereby, it is possible to easily produce the organic light emitting device that emits light in a predetermined pattern. It is unnecessary to use an additional device to emit light in the pattern, a production process may be simple, and there is an advantage in terms of cost. In particular, in the case of when DLP is used to change the function, it is possible to more easily realize a gray scale and more finely and precisely control the gray scale as compared to the case of when an organic light emitting device that emits light in a predetermined pattern by using a photomask and the like is produced.

Brief Description of the Drawings

[0012]

Fig. 1 is a sectional view of a conventional organic light emitting device including a patterned insulating layer;

Fig. 2 is a sectional view illustrating changing of functions of a predetermined pattern region of a specific organic material layer due to exposure according to an embodiment of the present invention;

Fig. 3 is a sectional view illustrating separately controlling of exposure of regions to change functions of a predetermined pattern region of a specific organic material layer;

Fig. 4 illustrates a light emitting pattern of the device that is produced in Example 1;

Fig. 5 is a sectional view illustrating separately controlling of exposure of regions by using DLP to change the function of an organic material layer according to the shape of a digital patterning image;

Fig. 6 is a picture illustrating operation of micromirrors that constitute a DMD (digital micromirror de-

vice) used to perform DLP by using a microscope; and

Fig. 7 is a graph illustrating the changed degree in the function of the organic material layer according to the degree of UV radiation.

Best Mode for Carrying Out the Invention

[0013] A detailed description of the present invention will be given hereinafter.

[0014] A method of producing an organic light emitting device according to the present invention includes changing functions of predetermined pattern regions of one or more layers of an organic material layer in the device so that the organic light emitting device can emit light in a predetermined pattern.

[0015] Specifically, a step of changing the functions of predetermined pattern regions of one or more layers of the organic material layer may be a step of providing an additional function to the region having the changed function so that the region corresponds to a light emitting region of the organic light emitting device or removing a function from the region so that the region corresponds to a non-light emitting region.

[0016] In the present invention, the above-mentioned step is performed so that functions of a predetermined pattern region and the other regions in one or more layers constituting the organic light emitting device are different from each other and the layer containing the regions having the different functions affects the light emitting pattern of the organic light emitting device to force the organic light emitting device to emit light in the predetermined pattern.

[0017] Specifically, in the present invention, the layer in which the function of the predetermined pattern region is changed is the organic material layer. In the present invention, when the layer in which the function of the predetermined pattern region is changed is a charge transporting layer, for example, a layer that injects and/or transports a hole, since the function of the predetermined pattern region of the layer is changed during the above-mentioned step, charge transporting efficiencies of the predetermined pattern region and the other regions are different from each other. Due to a difference in charge transporting efficiency into the light emitting layer, light is emitted from the light emitting layer according to the light emitting pattern that corresponds to the predetermined pattern region of the charge transporting layer.

[0018] In the related art, in order to produce the organic light emitting device having the light emitting pattern, it is necessary to form an additional layer, for example, an insulating layer, in addition to the layers constituting the organic light emitting device so that a predetermined pattern is obtained. However, in the present invention, since the above-mentioned step is included, it is unnecessary to form an additional layer or pattern the layer unlike a known process, and the function of only the predetermined pattern region needs to be changed in respects to one or more layers constituting the organic light emitting device so as to easily produce the organic light emitting device having the light emitting pattern. Accordingly, in the present invention, steps of the process may be significantly reduced to increase process efficiency and costs of material and process may be reduced.

[0019] In addition to the above-described advantages of the process, the following advantages can be obtained. Since the organic light emitting device that is produced by using a method of producing the organic light emitting device according to the present invention does not include layers other than the layers constituting the organic light emitting device, problems such as deterioration in interlayer interface properties and reduction in light emitting efficiency that may occur when the layers other than the layers constituting the organic light emitting device are provided like the known process may be prevented.

[0020] Additionally, in the conventional process using the patterned insulating layer, light emission is 0% and 100% at a portion where the insulating layer is formed and at another portion where the insulating layer is not formed, respectively. In detail, the light emitting pattern is obtained only by using an on/off form. However, in the present invention, the degree of the changing of the functions of the predetermined pattern regions of one or more layers constituting the organic light emitting device is controlled to form a light emitting pattern having a gray scale in which light emission gradually changes from a high light emitting portion via a medium light emitting portion to a low emitting portion, that is, a desirable gradation, as well as an on/off type light emitting pattern.

[0021] Furthermore, in the present invention, since various types of methods may be selected as a method of changing the function of the predetermined pattern region of the layer, it is possible to produce an organic light emitting device having a light emitting pattern without a mask unlike the conventional process in which the mask needs to be used to form the patterned insulating layer.

[0022] As described above, in the present invention, the layer in which the function of the predetermined pattern region is changed is one or more layers of the organic material layer. In the case of when the organic light emitting device according to the present invention includes an organic material layer having a multilayered structure, the organic material layer in which the function of the predetermined pattern region is changed may be one or more layers selected from a hole injecting and a hole transporting, or a layer having two or more functions among the functions of the above-mentioned layers. Alternatively, the organic material layer may be a layer that is additionally formed not to provide the functions but to form the light emitting pattern according to the purpose of the present invention. However, in views of light emitting efficiency, it is more preferable that the organic material layer be a layer for performing charge transportation, for example, hole or hole transportation.

[0023] In the present invention, a process of changing

the functions of the predetermined pattern regions of one or more layers of the organic material layer is not limited as long as the purpose is achieved. For example, the process may be performed by means of an optical process, for example processes using UV, a laser, or an e-beam.

[0024] In particular, in the case of when DLP is used as a means for changing the functions of the predetermined pattern regions of one or more layers of the organic material layer, the functions of the predetermined pattern regions may be finely changed.

[0025] The mechanism of the DLP is as follows. The DLP is short for digital light processing and developed by researchers of Texas Instruments, Inc. in the year 1987. In the DLP, an image is processed by using a DMD (digital micromirror device). The DMD may include 750,000 or more micromirrors. Since an image is shown by using the reflecting mirrors, there are advantages in that light efficiency is excellent and a fine image can be obtained.

[0026] A digital configuration is advantageous in that a desired image can be precisely obtained with high reliability as compared to an analog configuration and products have a small size and are light in weight. A digital image is a combination of many 0 and 1 signals. A DMD module that is the kernel of the DLP technology may be operated according to the combination of the digital signals. In detail, the combination of digital image signals that are transmitted from video memories or video processors is expressed by operation of the micromirrors constituting the DMD.

[0027] For example, each of the micromirrors of the DMD module may have the shape of a square having the size of 16 x 16 micrometers (microns), and an interval between the micromirrors may be less than 1 micrometer and the micromirrors may be very densely disposed. Both edges of each of the micromirrors that are contained in the DMD module used to perform the DLP are moved by using the digital signals of 0 and 1 to express digital image signals. Each of the micromirrors may rotate right and left by, for example, 0 to 10°, and the digital image signals that are saved in video memories are transmitted to driving apparatuses of the micromirrors to operate the micromirrors. The rotation of the mirrors is expressed by the fine pixels, and the light and the shade of the pixels are expressed based on the above-mentioned mechanism. The micromirrors that constitute the DMD module used to perform DLP are illustrated in Fig. 6. The size and the rotation angle of the micromirror are given to illustrate, but are not to be construed to limit the present invention.

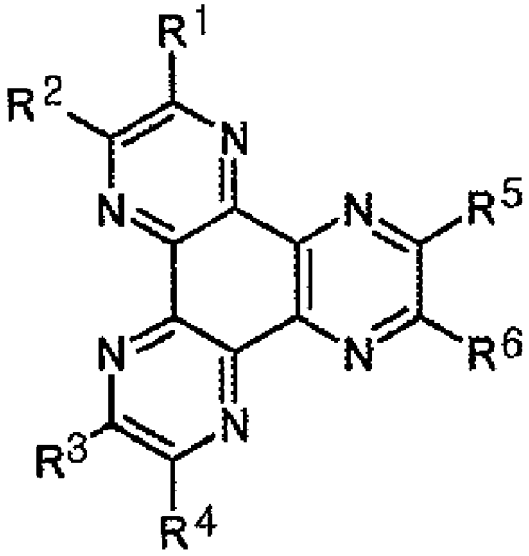
[0028] The DLP is performed according to a mechanism that is similar to that of a card section in a sports stadium. In the card section, a whole image is expressed by using movement of boards. In the DMD, boards are formed of mirrors and, when rays are radiated from a light source at a predetermined position in a predetermined direction, the rays reflect by movement of the mirrors and lens portions through which the rays penetrate and the other portions through which the rays cannot penetrate form a single image.

[0029] In the case of when a black-and-white picture is to be formed, a gray tone color sense needs to be expressed in addition to the white and black colors. In the DMD, the color sense may be expressed by using the mechanism of the card section of 0 and 1 that are changed several thousands times per one second. For example, when the DMD mirrors are to be moved 1000 times per unit time, if a frequency of 0 and 1 is finely controlled by using the mirrors, it is possible to very precisely control color tones of pixels. A movement speed of the micromirror of the DMD may be set to 500,000 or more times per second. Thereby, the light and the shade of black and white colors are expressed and a gray scale image may be outputted by using a digital configuration.

[0030] Therefore, in the DLP, an energy source may be selectively applied to an organic material layer, so that the function of the predetermined pattern region of the organic material layer is selectively changed.

[0031] The organic material layer in which the function is capable of being changed by using the above-mentioned optical method is a layer that includes the compound represented by Formula 1. The compound of Formula 1 may function to inject and/or transport a hole in the organic light emitting device, but the injecting and/ or transporting functions of the region that is treated by the above-mentioned optical method may be partially or totally removed. Fig. 7 is a graph illustrating change of the function of the organic material layer including the compound of Formula 1 according to radiation of UV.

[Formula 1]

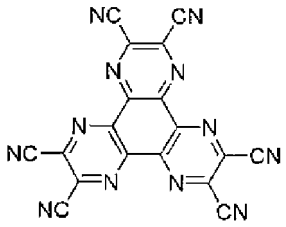


wherein R^1 to R^6 are each selected from the group consisting of hydrogen, a halogen atom, nitrile (-CN), nitro ($-NO_2$), sulfonyl ($-SO_2R$), sulfoxide (-SOR), sulfonamide

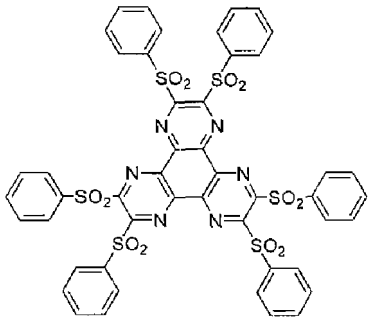
($-SO_2NR$), sulfonate ($-SO_3R$), trifluoromethyl ($-CF_3$), ester (-COOR), amide (-CONHR or -CONRR'), substituted or unsubstituted straight- or branched-chained C_1-C_{12} alkoxy, substituted or unsubstituted straight- or branched-chained C_1-C_{12} alkyl, a substituted or unsubstituted aromatic or nonaromatic hetero ring, substituted or unsubstituted aryl, substituted or unsubstituted mono- or di-arylamine, and substituted or unsubstituted aralkylamine, and R and R' are each selected from the group consisting of substituted or unsubstituted C_1-C_{60} alkyl, substituted or unsubstituted aryl, and a substituted or unsubstituted five- to seven-membered hetero ring.

[0032] The compound of Formula 1 may be selected from the compounds represented by Formulae 1-1 to 1-6.

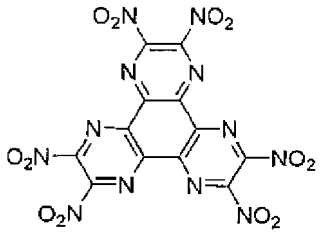
[Formula 1-1]



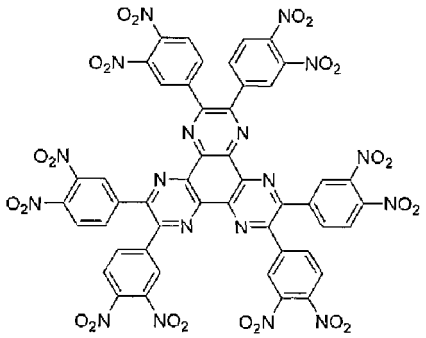
[Formula 1-2]



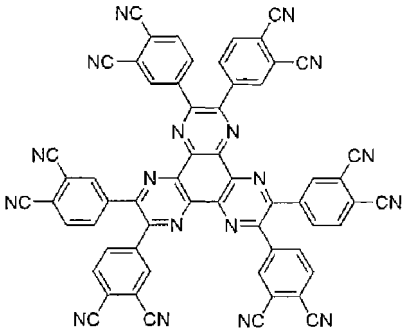
[Formula 1-3]



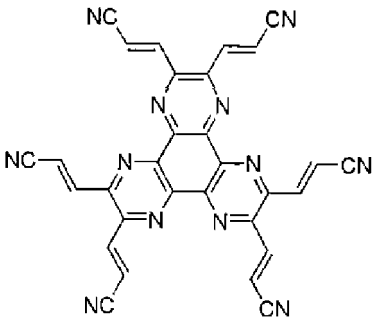
[Formula 1-4]



[Formula 1-5]



[Formula 1-6]



[0033] In the present invention, the step of changing the functions of the predetermined pattern regions of one or more layers of the organic material layer may be performed after the other organic material layers are formed or after the second electrode is formed, as long as it is performed after the layer in which the function of the predetermined pattern region is changed is formed. However, preferably, the step is performed after the layer in which the functions of the predetermined pattern regions are to be changed is formed and before the other organic material layers or the second electrodes are formed.

[0034] Furthermore, the step of changing the functions of the predetermined pattern regions of one or more layers of the organic material layer may be performed so that the organic light emitting device realizes on/off or various types of light emitting gradations by controlling the degree of the changing of the functions according to the position of the pattern region, for example, by controlling exposure in the case of when the optical method is used. For example, all of the functions of the predetermined pattern regions are changed to form a light emitting pattern so that the intensity of emitted light is expressed by an on/off form at the region where the functions are changed and the region where the functions are not changed. Furthermore, exposure may be controlled according to the position of the pattern region so that the degree of changing of the functions varies, thus forming the light emitting pattern having two different intensities of emitted light. An example relating to this is illustrated in Figs. 2 and 3. In Fig. 2, UV is radiated on the non-light emitting region to completely remove the function of the region, so that the produced organic light emitting device displays two intensities of emitted light of the light emitting region A and the non-light emitting region B, that is, on/off intensities. In Fig. 3, photomasks that are capable of controlling radiation of UV according to the position of regions are used. Thus, the degree of changing of the functions of the pattern regions varies so that the organic light emitting device has various types of light emitting intensities. In Fig. 3, A, A', and A" that denote the intensities of emitted light of the light emitting regions and B that denotes the intensity of emitted light of the non-light emitting region may have the different degrees of brightness. In addition, the step of changing the functions of the pattern regions may be performed through a single stage or through multiple stages to change at least a portion of functions of the different pattern regions.

[0035] In order to ensure the light emitting pattern where the gradation is expressed, photomasks having various types of materials or thicknesses may be used or exposure may be controlled to adjust exposure according to the type of region. For example, in order to express a pattern having three or more different intensities of emitted light, a photomask that is made of various types of materials or has various thicknesses and is capable of controlling permeation of light according to the region may be used, a plurality of photomasks that is made of various types of materials or has various thicknesses may be used, or a light source that is capable of controlling radiation of light according to the region may be used.

[0036] Fig. 5 illustrates the change in function that is controlled by using the DLP. The controlling is performed based on the above mechanism. In the case of when the DLP is used, all of the functions of the predetermined pattern regions may be changed to ensure the light emitting pattern where the intensity of emitted light is expressed in the on/off form at the region where the functions are changed and at the region where the functions are not changed. Furthermore, exposure may be controlled according to the type of region so that the degree of the changing of the functions varies. Thereby, it is possible to ensure the light emitting pattern so that two or more different intensities of emitted light are obtained.

[0037] The organic light emitting device according to the present invention may be produced by using a typical method of producing an organic light emitting device and a typical material, except that the functions of the predetermined pattern regions of one or more constituent layers are changed. For example, metal or metal oxide having conductivity or an alloy thereof is deposited on a substrate by using a PVD (physical vapor deposition) process such as sputtering or e-beam evaporation to form an anode, an organic material layer that includes a hole injecting layer, a hole transporting layer, a light emitting layer, and an electron transporting layer is formed, and a material that is capable of being used to form a cathode is deposited to produce the organic light emitting device according to the present invention. Alternatively, a cathode material, an organic material layer material, and an anode material may be sequentially deposited on the substrate in order to produce an organic light emitting device having an inverted structure.

[0038] The organic material layer may be produced by means of a solvent process, not a deposition process, using various types of polymer materials, for example, spin coating, dip coating, doctor blading, screen printing, inkjet printing, or heat transcription so as to include a small number of layers.

[0039] In addition, the present invention provides an organic light emitting device that is produced by using the production method. The organic light emitting device includes a first electrode, one or more organic material layers that are disposed on the first electrode, and a second electrode that is disposed on the organic material layers, wherein one or more layers of the organic material layers are layers in which functions of predetermined pattern regions are changed. The organic light emitting device according to the present invention may have a light emitting pattern having gradation that is not obtained in the case of when the pattern is formed by using the insulating layer. The layer in which the function of the predetermined pattern region is changed may be a layer which has an additional function to correspond to the light emitting region of the organic light emitting device or from which the function is removed to correspond to the non-light emitting region.

[0040] The organic light emitting device of the present invention may have a typical structure, except that the organic light emitting device has an organic material layer where at least a portion of the functions of the predetermined pattern regions is changed. The organic material layer of the organic light emitting device of the present invention may have a single-layered structure including one layer or a multilayered structure having two or more layers including the light emitting layer. In the case of when the organic material layer of the organic light emit-

ting device of the present invention has the multilayered structure, the organic material layer may have a structure that includes a hole injecting layer, a hole transporting layer, a light emitting layer, and an electron transporting layer. However, the structure of the organic light emitting device is not limited thereto, but the organic light emitting device may include a smaller number of organic material layers. The organic light emitting device of the present invention may be an organic light emitting device having a normal structure or an organic light emitting device having an inverted structure. Additionally, the organic light emitting device according to the present invention may be classified into a top light emitting type, a bottom light emitting type, or a dual-sided light emitting type according to the type of used material.

Mode for the Invention

[0041] A better understanding of the present invention may be obtained in light of the following Examples which are set forth to illustrate, but are not to be construed to limit the present invention.

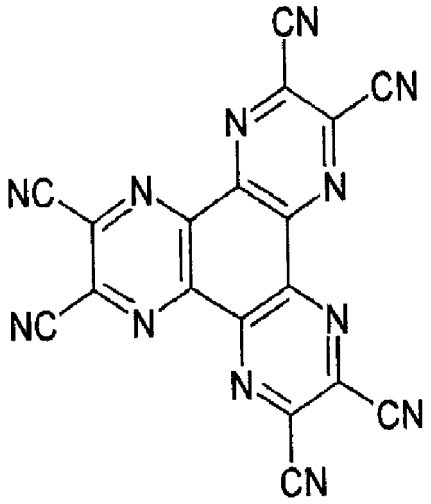
EXAMPLE 1

[0042] The glass substrate that was thinly coated with ITO (indium tin oxide) to a thickness of 1500 Å was immersed in distilled water in which a detergent was dissolved and washed with an ultrasonic wave. After ITO was washed for 30 min, the ultrasonic wave washing was repeated twice by using distilled water for 10 min. After the washing using distilled water was finished, the ultrasonic wave washing was performed by using a solvent including as isopropyl alcohol, acetone, or methanol, dried, and transported to a plasma washing machine. Additionally, the substrate was washed by using an oxygen plasma for 5 min and then transported to a vacuum deposition machine.

[0043] Hexanitrile hexaazatriphenylene (HAT) of the following formula was deposited on the prepared ITO transparent electrode in a vacuum by heating to a thickness of 100 Å to form the hole injecting layer, the pattern mask made of soda lime covered the resulting layer, and UV was radiated thereon by using a high pressure mercury UV lamp having a capacitance of 1 kW for about 5 min.

[HAT]

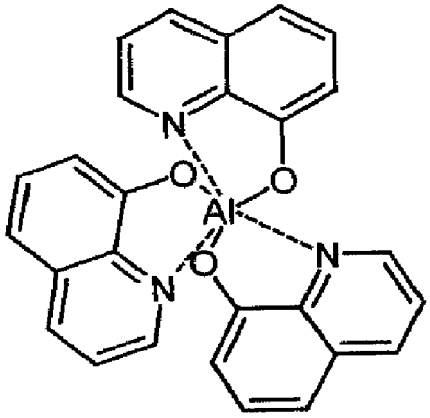
[0044]



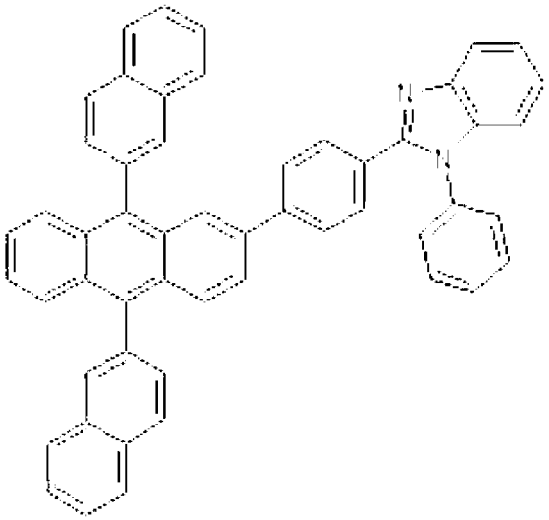
[0045] The substance that was used to transport a hole, 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (NPB) (400Å) was deposited on the hole injecting layer in a vacuum to form a hole transporting layer. Subsequently, an Alq3 light emitting substance of the following formula was deposited on the hole transporting layer in a vacuum to form a light emitting layer.

[Alq3]

[0046]



[0047] The following compound was deposited on the light emitting layer in a vacuum to a thickness of 200 Å to form an electron injecting and transporting layer.



[0048] Lithium fluoride (LiF) and aluminum were sequentially deposited on the electron injecting and transporting layer to a thickness of 12 Å and 2000 Å, respectively, to form a cathode.

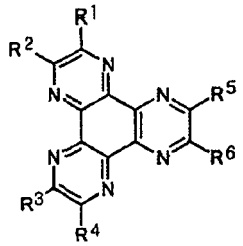
[0049] In this connection, the deposition rate of the organic substance was maintained at 0.4 to 0.7 Å/sec, the deposition rate of lithium fluoride of the cathode was maintained at 0.3 Å/sec, the deposition rate of aluminum was maintained at 2 Å/sec, and the degree of vacuum was maintained at 2×10^{-7} to 5×10^{-8} torr during the deposition (1 torr equals 133.322 Pa).

[0050] In the case of when a forward electric field of 5.7 V was applied to the organic light emitting device to emit light, light emitting properties were changed at a portion where properties of the organic substance were changed due to exposure to UV, thereby forming a predetermined pattern. This is illustrated in Fig. 4.

Claims

1. A method of producing an organic light emitting device, comprising the steps of preparing a first electrode; forming one or more organic material layers on the first electrode; and forming a second electrode on the one or more organic material layers, wherein the method comprises the step of changing functions of predetermined pattern regions of one or more layers of the one or more organic material layers, **characterized in that** the one or more layers of the one or more organic material layers in which the functions of the predetermined pattern regions are changed comprise an organic material layer containing a compound represented by Formula 1:

[Formula 1]



wherein R^1 to R^6 are each selected from the group consisting of hydrogen, a halogen atom, nitrile (-CN), nitro ($-NO_2$), sulfonyl ($-SO_2R$), sulfoxide (-SOR), sulfonamide ($-SO_2NR$), sulfonate ($-SO_3R$), trifluoromethyl ($-CF_3$), ester (-COOR), amide (-CONHR or -CONRR'), substituted or unsubstituted straight- or branched-chained C_1-C_{12} alkoxy, substituted or unsubstituted straight- or branched-chained C_1-C_{12} alkyl, a substituted or unsubstituted aromatic or non-aromatic hetero ring, substituted or unsubstituted aryl, substituted or unsubstituted mono- or di-arylamine, and substituted or unsubstituted aralkylamine, and R and R' are each selected from the group consisting of substituted or unsubstituted C_1-C_{60} alkyl, substituted or unsubstituted aryl, and a substituted or unsubstituted five- to seven-membered hetero ring.

2. The method according to claim 1, wherein the changing of the functions of the predetermined pattern regions of the one or more layers of the one or more organic material layers includes providing additional functions to the predetermined pattern regions so that each of the predetermined pattern regions where the functions are changed corresponds to a light emitting region of the organic light emitting device, or removing the functions from the predetermined pattern regions so that each of the predetermined pattern regions where the functions are changed corresponds to a non-light emitting region of the organic light emitting device

3. The method according to claim 1, wherein the organic material layer of the one or more layers of the one or more organic material layers in which the functions of the predetermined pattern regions are changed has one or more functions selected from the group consisting of hole injecting and hole transporting.

4. The method according to claim 1, wherein the changing of the functions of the predetermined pattern regions of the one or more layers of the one or more organic material layers is performed by using an optical process.

5. The method according to claim 4, wherein the chang-

ing of the functions of the predetermined pattern regions of the one or more layers of the one or more organic material layers is performed by using radiation of UV, a laser, or an e-beam or is performed by using DLP (digital light processing).

6. The method according to claim 1, wherein the changing of the functions of the predetermined pattern regions of the one or more layers of the one or more organic material layers is performed after the one or more layers of the one or more organic material layers where the functions of the predetermined pattern regions are changed are formed and before the other layers of the one or more organic material layers are formed.

7. The method according to claim 4, wherein the changing of the functions of the predetermined pattern regions of the one or more layers of the one or more organic material layers includes controlling exposure according to a type of the predetermined pattern regions to adjust the degree of a changing of functions of the compound contained in the organic material layer of the one or more layers of the one or more organic material layers so that the organic light emitting device expresses two or more intensities of emitted light.

8. The method according to claim 7 wherein the controlling of the exposure is performed by using a process of controlling permeation of a photomask or a process of controlling the intensity of light of a light source.

9. An organic light emitting device comprising a first electrode; one or more organic material layers that are disposed on the first electrode; and a second electrode that is disposed on the one or more organic material layers, wherein one or more layers of the one or more organic material layers are one or more layers of the one or more organic material layers in which functions of predetermined pattern regions are changed, **characterized in that** the one or more layers of the one or more organic material layers in which the functions of the predetermined pattern regions are changed comprise an organic material layer containing a compound represented by the Formula 1 of claim 1

wherein R^1 to R^6 are each selected from the group consisting of hydrogen, a halogen atom, nitrile (-CN), nitro ($-NO_2$), sulfonyl ($-SO_2R$), sulfoxide (-SOR), sulfonamide ($-SO_2NR$), sulfonate ($-SO_3R$), trifluoromethyl ($-CF_3$), ester (-COOR), amide (-CONHR or -CONRR'), substituted or unsubstituted straight- or branched-chained C_1-C_{12} alkoxy, substituted or unsubstituted straight- or branched-chained C_1-C_{12} alkyl, a substituted or unsubstituted aromatic or non-aromatic hetero ring, substituted or unsubstituted aryl, substituted or unsubstituted mono- or di-arylamine, and substituted or unsubstituted aralkylamine, and R and R' are each selected from the group consisting of substituted or unsubstituted C_1-C_{60} alkyl, substituted or unsubstituted aryl, and a substituted or unsubstituted five- to seven-membered hetero ring.

10. The organic light emitting device according to claim 9, wherein each of the one or more layers of the one or more organic material layers in which the functions of the predetermined pattern regions are changed is a layer to which additional functions are provided to the predetermined pattern regions so that each of the predetermined pattern regions where the functions are changed corresponds to a light emitting region of the organic light emitting device, or a layer from which the functions are removed from the predetermined pattern regions so that each of the predetermined pattern regions where the functions are changed corresponds to a non-light emitting region of the organic light emitting device.

11. The organic light emitting device according to claim 9, wherein the organic material layer of the one or more layers of the one or more organic material layers in which the functions of the predetermined pattern regions are changed has one or more functions selected from the group consisting of hole injecting and hole transporting.

12. An electronic apparatus comprising the organic light emitting device according to any one of claims 9 to 11.

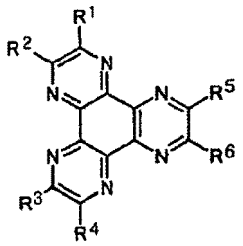
Patentansprüche

1. Ein Verfahren zum Herstellen einer organischen lichtemittierenden Vorrichtung, aufweisend die folgenden Schritte
Bereitstellen einer ersten Elektrode;
Bilden von einer oder mehreren organisches-Material-Schichten auf der ersten Elektrode; und
Bilden einer zweiten Elektrode auf der einen oder den mehreren organisches-Material-Schichten, wobei das Verfahren aufweist:

den Schritt des Änderns von Funktionen von vorbestimmtes-Muster-Bereichen von einer oder mehreren Schichten der einen oder der mehreren organisches-Material-Schichten,
dadurch gekennzeichnet, dass
die eine oder die mehreren Schichten der einen oder mehreren organisches-Material-Schichten, in denen die Funktionen der vorbestimmtes-Muster-Bereiche geändert werden, eine organisches-Material-Schicht aufweisen, die eine che-

mische Verbindung enthält, welche repräsentiert wird durch die Formel 1:

[Formel 1]



wobei R_1 bis R^6 jeweils ausgewählt sind aus der Gruppe bestehend aus Wasserstoff, einem Halogenatom, Nitril (-CN), Nitro ($-NO_2$), Sulfonyl ($-SO_2R$), Sulfoxid (-SOR), Sulfonamid ($-SO_2NR$), Sulfonat ($-SO_3R$), Trifluormethyl ($-CF_3$), Ester (-COOR), Amid (-CONHR oder -CONRR'), substituiertem oder unsubstituiertem, linearem oder verzweigtem C_1-C_{12}-Alkoxy, substituiertem oder unsubstituiertem, linearem oder verzweigtem C_1-C_{12}-Alkyl, einem substituierten oder unsubstituierten, aromatischen oder nichtaromatischen Heterocyclus, substituiertem oder unsubstituiertem Aryl, substituiertem oder unsubstituiertem Mono-Arylamin oder Di-Arylamin und substituiertem oder unsubstituiertem Aralkylamin, und R und R' jeweils ausgewählt sind aus der Gruppe bestehend aus substituiertem oder unsubstituiertem C_1-C_{60}-Alkyl, substituiertem oder unsubstituiertem Aryl und einem substituierten oder unsubstituierten 5- bis 7-gliedrigen Heterocyclus.

2. Das Verfahren gemäß Anspruch 1, wobei das Ändern der Funktionen der vorbestimmtes-Muster-Bereiche der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten aufweist ein Bereitstellen zusätzlicher Funktionen an die vorbestimmtes Muster-Bereiche, sodass jeder der vorbestimmtes-Muster-Bereiche, in dem die Funktionen geändert werden, einem lichtemittierenden Bereich der organischen lichtemittierenden Vorrichtung entspricht, oder ein Entfernen der Funktionen von den vorbestimmtes-Muster-Bereichen, sodass jeder der vorbestimmtes-Muster-Bereiche, in dem die Funktionen geändert werden, einem nichtlichtemittierenden Bereich der organischen lichtemittierenden Vorrichtung entspricht.

3. Das Verfahren gemäß Anspruch 1, wobei die organisches-Material-Schicht der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten, in denen die Funktionen der vorbestimmtes-Muster-Bereiche geändert werden, eine oder mehrere Funktionen hat ausgewählt aus der Gruppe bestehend aus Lochinjektion und Lochtransport.

4. Das Verfahren gemäß Anspruch 1, wobei das Ändern der Funktionen der vorbestimmtes-Muster-Bereiche der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten durchgeführt wird unter Verwendung eines optischen Prozesses.

5. Das Verfahren gemäß Anspruch 4, wobei das Ändern der Funktionen der vorbestimmtes-Muster-Bereiche der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten durchgeführt wird durch Verwenden von UV-Strahlung, Strahlung eines Lasers oder Strahlung eines Elektronenstrahls, oder durchgeführt wird durch Verwenden von DLP (Digital Light Processing).

6. Das Verfahren gemäß Anspruch 1, wobei das Ändern der Funktionen der vorbestimmtes-Muster-Bereiche der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten durchgeführt wird, nachdem die eine oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten, wo die Funktionen der vorbestimmtes-Muster-Bereiche geändert werden, gebildet werden, und bevor die anderen Schichten der einen oder mehreren organisches-Material-Schichten gebildet werden.

7. Das Verfahren gemäß Anspruch 4, wobei das Ändern der Funktionen der vorbestimmtes-Muster-Bereiche der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten ein Steuern der Belichtung aufweist gemäß einem Typ der vorbestimmtes-Muster-Bereiche zum Anpassen des Grades einer Änderung von Funktionen der chemischen Verbindung, die enthalten ist in der organisches-Material-Schicht der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten, sodass die organische lichtemittierende Vorrichtung zwei oder mehr Intensitäten von emittiertem Licht ausdrückt.

8. Das Verfahren gemäß Anspruch 7, wobei das Steuern der Belichtung durchgeführt wird durch das Verwenden eines Prozesses zum Steuern der Permeation einer Fotomaske oder eines Prozesses zum Steuern der Lichtintensität einer Lichtquelle.

9. Eine organische lichtemittierende Vorrichtung aufweisend: eine erste Elektrode; eine oder mehrere organisches-Material-Schichten, die auf der ersten Elektrode angeordnet sind; und eine zweite Elektrode, die auf der einen oder mehreren organisches-Material-Schichten angeordnet ist, wobei

eine oder mehrere Schichten der einen oder mehreren organisches-Material-Schichten eine oder mehrere Schichten der einen oder mehreren organisches-Material-Schichten sind, in denen Funktionen von vorbestimmtes-Muster-Bereichen geändert werden,

dadurch gekennzeichnet, dass

die eine oder die mehreren Schichten der einen oder mehreren organisches-Material-Schichten, in denen die Funktionen der vorbestimmtes-Muster-Bereiche geändert werden, eine organisches-Material-Schicht aufweisen, die eine chemische Verbindung enthält, welche repräsentiert wird durch die Formel 1 des Anspruchs 1,

wobei R^1 bis R^6 jeweils ausgewählt sind aus der Gruppe bestehend aus Wasserstoff, einem Halogenatom, Nitril (-CN), Nitro ($-NO_2$), Sulfonyl ($-SO_2R$), Sulfoxid (-SOR), Sulfonamid ($-SO_2NR$), Sulfonat ($-SO_3R$), Trifluormethyl ($-CF_3$), Ester (-COOR), Amid (-CONHR oder - CONRR'), substituiertem oder unsubstituiertem, linearem oder verzweigtem C_1-C_{12}-Alkoxy, substituiertem oder unsubstituiertem, linearem oder verzweigtem C_1-C_{12}-Alkyl, einem substituierten oder unsubstituierten, aromatischen oder nichtaromatischen Heterocyclus, substituiertem oder unsubstituiertem Aryl, substituiertem oder unsubstituiertem Mono-Arylamin oder Di-Arylamin und substituiertem oder unsubstituiertem Aralkylamin, und

R und R' jeweils ausgewählt sind aus der Gruppe bestehend aus substituiertem oder unsubstituiertem C_1-C_{60}-Alkyl, substituiertem oder unsubstituiertem Aryl und einem substituierten oder unsubstituierten 5- bis 7-gliedrigen Heterocyclus

10. Die organische lichtemittierende Vorrichtung gemäß Anspruch 9, wobei jede der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten, in denen die Funktionen der vorbestimmtes-Muster-Bereiche geändert werden, eine Schicht ist, bei der zusätzliche Funktionen an die vorbestimmtes-Muster-Bereiche bereitgestellt sind, sodass jeder der vorbestimmtes-Muster-Bereiche, in dem die Funktionen geändert werden, einem lichtemittierendem Bereich der organischen lichtemittierenden Vorrichtung entspricht, oder eine Schicht ist, von der Funktionen von den vorbestimmtes-Muster-Bereichen entfernt werden, sodass jeder der vorbestimmtes-Muster-Bereiche, in dem die Funktionen geändert werden, einem nicht-lichtemittierenden Bereich der organischen lichtemittierenden Vorrichtung entspricht.

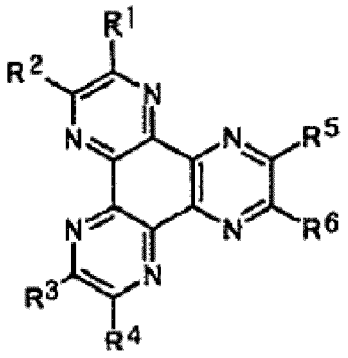
11. Die organische lichtemittierende Vorrichtung gemäß Anspruch 9, wobei die organisches Material-Schicht der einen oder mehreren Schichten der einen oder mehreren organisches-Material-Schichten, in denen die Funktionen der vorbestimmtes-Muster-Bereiche geändert werden, eine oder mehrere Funktionen hat ausgewählt aus der Gruppe bestehend aus Lochinjektion und Lochtransport.

12. Eine elektronische Vorrichtung aufweisend die organische lichtemittierende Vorrichtung gemäß irgendeinem der Ansprüche 9 bis 11.

Revendications

1. Procédé de production d'un dispositif électroluminescent organique, comprenant les étapes consistant à préparer une première électrode ; à former une ou plusieurs couches de matériaux organiques sur la première électrode ; et à former une seconde électrode sur la couche ou les couches de matériaux organiques, dans lequel le procédé comprend l'étape consistant à modifier les fonctions de zones de motifs prédéterminés d'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques, **caractérisé en ce que** la couche ou les couches parmi l'une ou plusieurs couches de matériaux organiques dans laquelle (lesquelles) les fonctions des zones de motifs prédéterminés sont modifiées comprennent une couche de matériaux organiques contenant un composé représenté par la Formule 1 :

[Formule 1]



formule dans laquelle les radicaux R^1 à R^6 sont chacun choisis dans le groupe constitué de l'atome d'hydrogène, d'un atome d'halogène, d'un groupe nitrile (-CN), d'un groupe nitro ($-NO_2$), d'un groupe sulfonyle ($-SO_2R$), d'un groupe sulfoxyde (-SOR), d'un groupe sulfonamide ($-SO_2NR$), d'un groupe sulfonate ($-SO_3R$), d'un groupe trifluorométhyle ($-CF_3$), d'un groupe ester (-COOR), d'un groupe amide (-CONHR ou - CONRR'), d'un groupe alcoxy en C_1 à C_{12} à chaîne linéaire ou ramifiée, substitué ou non substitué, d'un groupe alkyle en C_1 à C_{12} à chaîne linéaire ou ramifiée, substitué ou non substitué, d'un hétérocycle aromatique ou non aromatique, substitué ou

non substitué, d'un groupe aryle substitué ou non substitué, d'un groupe mono- ou di-arylamine substitué ou non substitué, et d'un groupe aralkylamine substitué ou non substitué, et R et R' sont chacun choisis dans le groupe constitué d'un groupe alkyle en C_1 à C_{60} substitué ou non substitué, d'un groupe aryle substitué ou non substitué, et d'un hétérocycle de cinq à sept chaînons substitué ou non substitué.

2. Procédé selon la revendication 1, dans lequel la modification des fonctions des zones de motifs prédéterminés de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques inclut l'apport de fonctions additionnelles aux zones de motifs prédéterminés de manière à ce que chacune des zones de motifs prédéterminés où les fonctions sont modifiées corresponde à une région électroluminescente du dispositif électroluminescent organique, ou la suppression des fonctions des zones de motifs prédéterminés de manière à ce que chacune des zones de motifs prédéterminés où les fonctions sont modifiées corresponde à une région non électroluminescente du dispositif électroluminescent organique.

3. Procédé selon la revendication 1, dans lequel la couche de matériaux organiques de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques dans laquelle (lesquelles) les fonctions des zones de motifs prédéterminés sont modifiées a une ou plusieurs fonctions choisies dans le groupe constitué de l'injection de trous et du transport de trous.

4. Procédé selon la revendication 1, dans lequel la modification des fonctions des zones de motifs prédéterminés de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques est réalisée à l'aide d'un procédé optique.

5. Procédé selon la revendication 4, dans lequel la modification des fonctions des zones de motifs prédéterminés de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques est réalisée par exposition à un rayonnement UV, à un laser ou à un faisceau électronique ou est réalisée par DLP (digital light processing, traitement numérique de la lumière).

6. Procédé selon la revendication 1, dans lequel la modification des fonctions des zones de motifs prédéterminés de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques est réalisée après la formation de la couche ou des couches parmi l'une ou plusieurs couches de matériaux organiques où les fonctions des zones de motifs prédéterminés sont modifiées et avant la formation des autres couches parmi l'une ou plusieurs couches de matériaux organiques.

7. Procédé selon la revendication 4, dans lequel la modification des fonctions des zones de motifs prédéterminés de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques inclut la régulation de l'exposition en fonction d'un type des zones de motifs prédéterminés pour ajuster le degré d'une modification des fonctions du composé contenu dans la couche de matériaux organiques de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques de manière à ce que le dispositif électroluminescent organique exprime deux intensités de lumière émise ou plus.

8. Procédé selon la revendication 7 dans lequel la régulation de l'exposition est réalisée à l'aide d'un procédé de régulation de la perméation d'un masque photographique ou d'un procédé de régulation de l'intensité de lumière d'une source de lumière.

9. Dispositif électroluminescent organique comprenant une première électrode ; une ou plusieurs couches de matériaux organiques qui sont disposées sur la première électrode ; et une seconde électrode qui est disposée sur la couche ou les couches de matériaux organiques, dans lequel une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques sont une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques dans laquelle (lesquelles) les fonctions de zones de motifs prédéterminés sont modifiées, **caractérisé en ce que** la couche ou les couches parmi l'une ou plusieurs couches de matériaux organiques dans laquelle (lesquelles) les fonctions des zones de motifs prédéterminés sont modifiées comprennent une couche de matériaux organiques contenant un composé représenté par la Formule 1 de la revendication 1

formule dans laquelle les radicaux R^1 à R^6 sont chacun choisis dans le groupe constitué de l'atome d'hydrogène, d'un atome d'halogène, d'un groupe nitrile (-CN), d'un groupe nitro ($-NO_2$), d'un groupe sulfonyle ($-SO_2R$), d'un groupe sulfoxyde (-SOR), d'un groupe sulfonamide ($-SO_2NR$), d'un groupe sulfonate ($-SO_3R$), d'un groupe trifluorométhyle ($-CF_3$), d'un groupe ester (-COOR), d'un groupe amide (-CONHR ou - CONRR'), d'un groupe alcoxy en C_1 à C_{12} à chaîne linéaire ou ramifiée, substitué ou non substitué, d'un groupe alkyle en C_1 à C_{12} à chaîne linéaire ou ramifiée, substitué ou non substitué, d'un hétérocycle aromatique ou non aromatique, substitué ou non substitué, d'un groupe aryle substitué ou non substitué, d'un groupe mono- ou di-arylamine substitué ou non substitué, et d'un groupe aralkylamine substitué ou non substitué, et R et R' sont chacun choisis dans le groupe constitué d'un groupe alkyle en C_1 à C_{60} substitué ou non substitué, d'un groupe

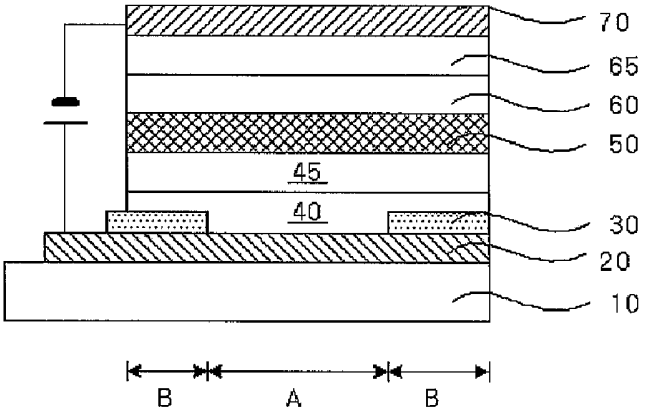
aryle substitué ou non substitué, et d'un hétérocycle de cinq à sept chaînons substitué ou non substitué.

10. Dispositif électroluminescent organique selon la revendication 9, dans lequel chacune de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques dans laquelle (lesquelles) les fonctions des zones de motifs prédéterminés sont modifiées est une couche dans laquelle des fonctions additionnelles sont apportées aux zones de motifs prédéterminés de manière à ce que chacune des zones de motifs prédéterminés où les fonctions sont modifiées corresponde à une région électroluminescente du dispositif électroluminescent organique,
ou une couche dont les fonctions sont supprimées des zones de motifs prédéterminés de manière à ce que chacune des zones de motifs prédéterminés où les fonctions sont modifiées corresponde à une région non électroluminescente du dispositif électroluminescent organique.

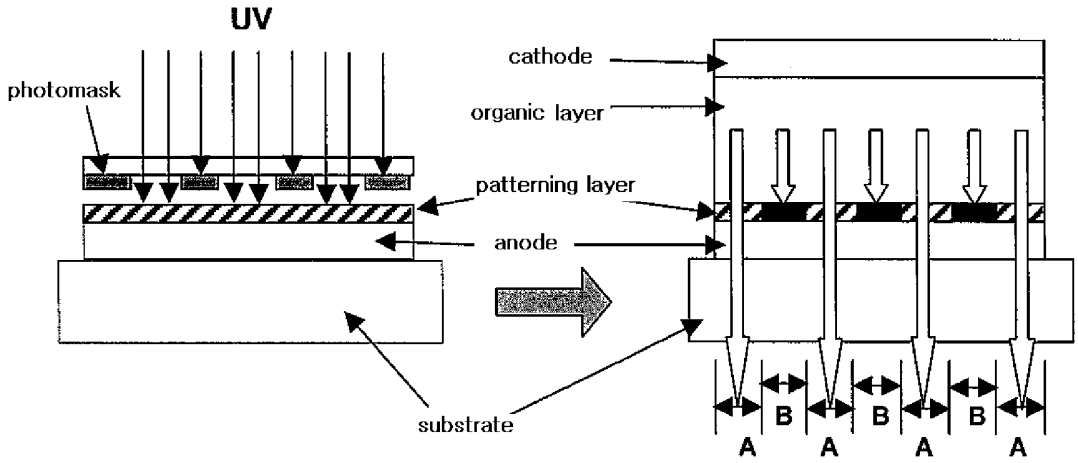
11. Dispositif électroluminescent organique selon la revendication 9, dans lequel la couche de matériaux organiques de l'une ou plusieurs couches parmi l'une ou plusieurs couches de matériaux organiques dans laquelle (lesquelles) les fonctions des zones de motifs prédéterminés sont modifiées a une ou plusieurs fonctions choisies dans le groupe constitué de l'injection de trous et du transport de trous.

12. Appareil électronique comprenant le dispositif électroluminescent organique selon l'une quelconque des revendications 9 à 11.

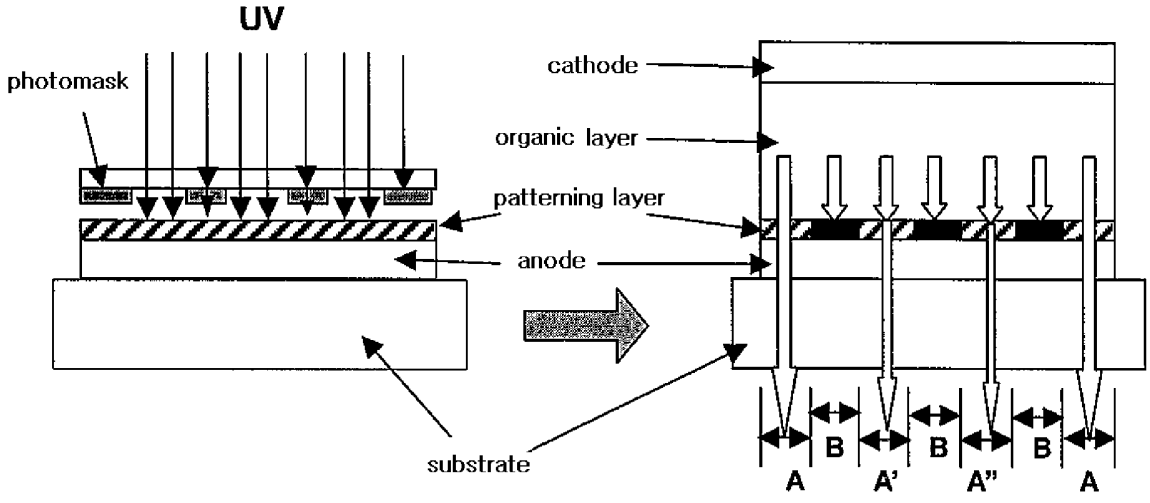
[Fig. 1]



[Fig. 2]



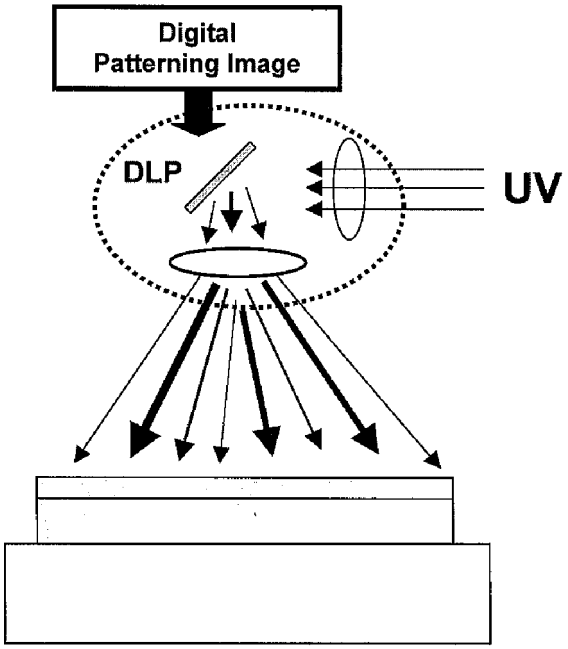
[Fig. 3]



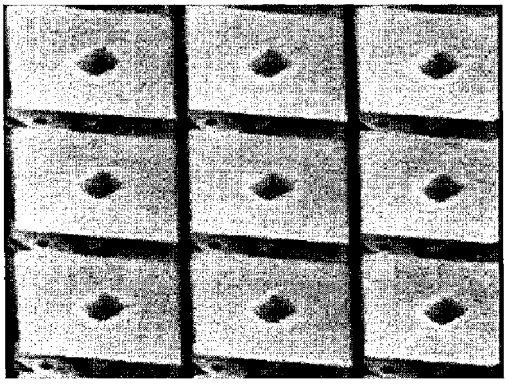
brightness : A ≠ A'≠ A"≠B

[Fig. 4]

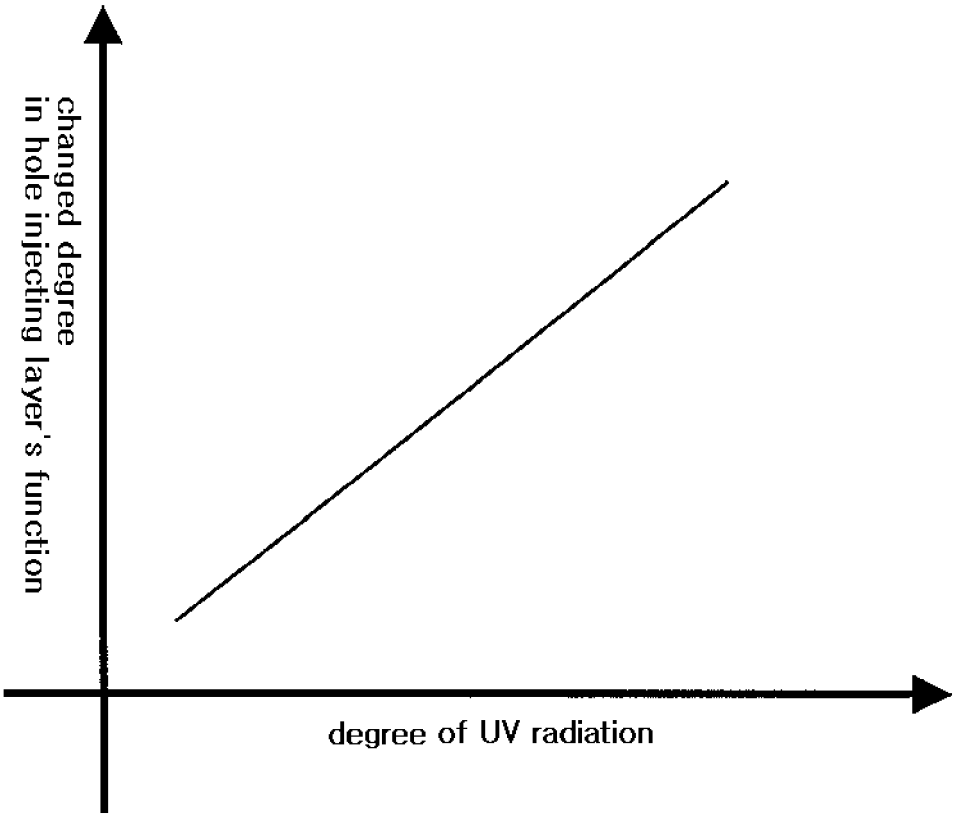
[Fig. 5]



[Fig. 6]



[Fig. 7]


changed degree
in hole injecting layer's function
degree of UV radiation

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2004077250 A1 **[0005]**